REMARKS

Claims 1-99 are pending in the present application. Claims 5, 6, 10, 12, 13, 15-25, 34-46, 54-56, 58, 61, 64-67, 69, 71-76, and 81-89 have been withdrawn from consideration. Claims 1-4, 7-9, 11, 14, 26-33, 47-53, 57, 59, 60, 62, 68, 70, 77-80 and 92-99 stand rejected. Claims 17-19, 21, 23-25, 71-76 and 81-91 have been cancelled herein, without prejudice. Claims 1, 3, 4, 28, 34, 41-43, 47 and 92 have been amended and new Claims 100-123 have been added herein. The above amendments and following remarks are believed to be fully responsive to the outstanding Office Action.

I. The restriction is still respectfully traversed. Reconsideration is requested, especially for Claims 34-46, 63 and 65. The newly added claims fall within the previously elected species. It is further unclear as to whether Claims 62, 63, 90 and 91 have been withdrawn or not; therefore, it has been presumed that they are not withdrawn, and that 63, 90 and 91 are allowed.

The Examiner is also thanked for the courtesies extended to Applicants' Representative during a March 27, 2008 telephonic interview. The prior restriction was discussed and the Examiner agreed that reconsideration would be given. Furthermore, it was agreed that Applicants' prior election was fully compliant such that no alleged noncompliance should count against any patent term adjustment.

II. The Examiner has rejected Claims 1-4, 7-9, 11, 14, 26-33, 47-51, 53, 57, 59, 60, 62, 68, 70, 77-80 and 92-99 under 35 U.S.C. §103(a) as allegedly being unpatentable over Silberberg (U.S. Patent No. 6,327,068) in view of A. Weiner, "Femtosecond Pulse Shaping Using Spatial Light Modulators," Rev. Sci. Instrum., Vol. 71, No. 5, pp. 1929-1960 (May 2000) (hereinafter "the 2000 Weiner publication"). This rejection is

respectfully traversed. It is believed that the originally filed claims are patentably distinct over the cited references. Reconsideration is requested.

III. As an initial matter for many of these claims, the Examiner has improperly discounted functional claim terminology since means plus function elements under 35 U.S.C. § 112, paragraph six, were not employed. Appellant agrees that §112, paragraph six, terminology was not used, but the Examiner has misapplied the law on the issue.

As should be done with the present application, the *In re Miller* Court reversed "a section 112 rejection made on the ground that particular language was functional and thus indefinite" and held that "we are unable to see merit in any proposition which would require the denial of the claim *solely* because of the *type* of language used to define the subject matter for which patent protection is sought." 169 U.S.P.Q. 597, 599 (CCPA 1971). "*All words* in a claim must be considered in judging the patentability of that claim against the prior art." *Id.* at 600; *see also Microprocessor Enhancement Corp. v.. Texas Instruments Inc.*, 86 U.S.P.Q.2d 1225, 1230 (Fed. Cir. 2008) ("[f]unctional language may also be employed to limit the [apparatus] claims without using the means-plus-function format"). The Examiner erred by improperly ignoring the allegedly "functional recitation" in Claims 1-3, 9, 11, 14, 26, 27, 29-33, 53, 57, 63, 65, 68, 77-80, 92 and 95-99.

IV. Second, a 2007 article authored by A. Weiner states that the experiment of the 2000 Wiener publication was defective and non-enabling. "[O]wing to the complexity of the all-order PMD-induced pulse distortion and the limits of the Gerchberg – Saxton algorithm, an interactive measure-compensate-measure procedure was necessary,

which lacked the robustness that will be needed for real applications." H. Miao and A. Weiner, "Sensing and Compensation of Femtosecond Waveform Distortion Induced by All-Order Polarization Mode Dispersion at Selected Polarization States," Optics Letters, Vol. 32, No. 4 (Feb. 15, 2000) at p. 424 (filed herewith as Exhibit A) (see citation at note 7). Thus, A. Weiner is disparaging his own prior 2000 Weiner publication cited by the Examiner, and is pointing out the differences versus the automatic control of Claim 1, the MIIPS characterization of Claims 53 and 77, and the MII control of Claims 92 and 111. Accordingly, it cannot be used in the combination proposed by the Examiner.

V. Third, the Silberberg patent does not disclose, and actually teaches away from, the invention of independent Claims 26, 53, 77, 92 and 111, and also various of the dependent claims. The claimed predetermined binary phase values (dependent Claim 101), and "multiphoton intrapulse interference" ("MII") or "multiphoton intrapulse interference phase scan" ("MIIPS") (Claims 26, 53, 77, 92 and 111), are not discussed anywhere in the Silberberg patent. Simply, Silberberg does not disclose any automatic control or interference of pulses in any manner, let alone MII or MIIPS.

The Silberberg patent is about "compression of femtosecond laser pulses using a programmable liquid crystal spatial light modulator which is feedback-controlled by an evolutionary algorithm." It is significant that the Abstract of Silberberg teaches away from the present application's Claims 26, 53, 77, 92 and 111 when Silberberg states "[o]ne of the main disadvantages associated with prior art pulse compressors, namely, the need for characterization of the uncompressed pulses, is thus eliminated. The compressor is thus capable of handling completely uncharacterized or from time varying sources." MII or MIIPS of Claims 26, 53, 77, 92 and 111, in combination with binary

shaping, however, beneficially characterizes the pulse. See the Abstract and Paragraph Nos. 0006, 0020-0022, 0041, 0054, 0067-0089, 0098, 0111, 0112, 0125, 0134 and 0135 of the present application.

The Silberberg experimental setup employs at least 500-2,000 iteration combinations, each combination being a "pulse shape" that needs to be evaluated by their feedback-controlled evolutionary algorithm. See column 7, line 57 – column 8, line 50, and Figure 3 of Silberberg. The number of pixel combinations is extremely large. The Silberberg interaction procedure will take between 10 and 100 minutes per evaluation as compared to about 20 seconds or less for the more accurate version of MII or MIIPS of the present invention, and even less when employed with binary phase shaping.

The method presented by Silberberg is impractical for achieving the present binary shaping claims. It can only be used practically for optimizing the total signal (integrated by a photomultiplier) obtained by SHG. Even this simplest of all processes is not solved accurately because the sensitivity of the feedback diminishes as one approaches the optimum result.

In contrast, binary phase shaping and multiphoton intrapulse interference allow for the predicted suppression of specific frequencies in nonlinear optical processes while leaving others at their maximum value, by way of example and not limitation. Armed with MII and MIIPS, it is possible to design phase functions that achieve the desired control in any nonlinear optical process. MII and MIIPS is what the Silberberg '068 patent teaches is <u>not</u> possible (see Silberberg Abstract). By way of example and not limitation, the present application teaches that multiphoton intrapulse interference

can be used in complex systems including proteins. Furthermore, the present inventors have shown the ability to deliver shaped pulses with sub 0.01 rad accuracy to the sample. By way of example and not limitation, the present application achieves this accuracy based on MII and MIIPS with binary values.

Using multiphoton intrapulse interference, the present inventors have been able to quickly and efficiently find functions that optimize practical nonlinear optical applications because the number of possibilities that need to be searched is hundreds of orders of magnitude smaller than Silberberg, for example. In many cases the optimal solution is found by computation (based on the MII or MIIPS equations) and is implemented directly without further experimental optimization being required. In other cases, when a computer model is not available, an exhaustive evaluation of all possible phase functions can be carried out in minutes. This would be essentially impossible with Silberberg's method.

By way of example and not limitation, the computer of the present application uses a program that encodes the requirements for MII or MIIPS to deliberately introduce phase functions known to cause MII or MIIPS. The computer avoids phases that are simple repetitions, or that are known not to cause MII or MIIPS. The Examiner's assertion that a pulse shaper connected to a random number generator will inherently cause MII or MIIPS is like saying that a computer generating random letters can write this exact sentence including the correct spacing without using grammatical rules or a dictionary containing these words. But, a unit operable to apply MII and MIIPS employing binary phase shaping in the pulse would be equivalent to a computer that contains the words in the previous sentence and the grammatical rules to help sorting

them in the correct order. Hence, this task would be done in seconds using these advantages.

The main preoccupation in the Silberberg patent is for the generation of "compressed" pulses, as is stated in its Abstract. The concern is therefore on the temporal width of the pulse. In contrast, the best evidence for MII or MIIPS is obtained in the spectrum of the SHG of the pulse, by way of example and not limitation.

For example and not by way of limitation, the following figure shows the effect of using the present application's device operable to introduce multiphoton intrapulse interference to cause selective excitation in the center of the spectrum and suppression of signal everywhere else. Notice the excellent agreement between theory (calculated) and experimental measurement of the SHG spectrum. This result can be obtained directly without the need of iteration or experimentation. In contrast, using random numbers as suggested by the Silberberg patent, the result would have been a random fluctuation; it is believed that the noise on the Silberberg data in Figure 3 is approximately 4% with a simple laser oscillation (with approximately 1% fluctuations), but an amplified laser would undesirably cause approximately 10% noise, thereby causing one to believe that Silberberg's Figure 3 data is only an approximation. The intensity outside the desired region would be much greater than at the desired frequency.

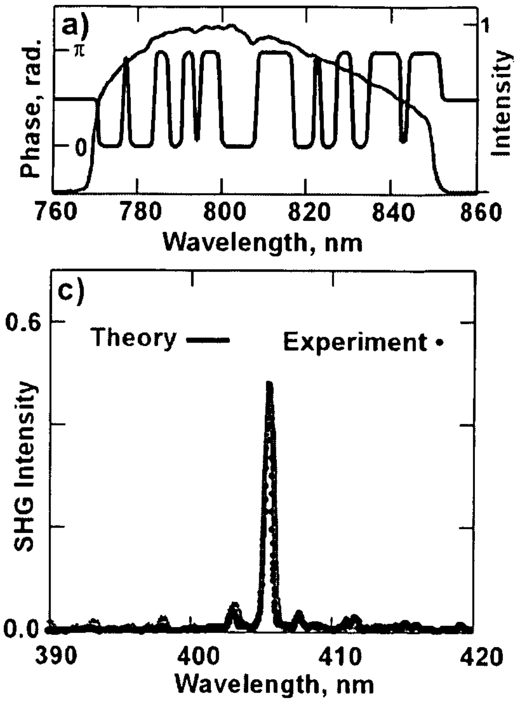

Figure Caption:

An illustration of the capabilities of a unit operable to introduce multiphoton intrapulse interference: The upper panel shows the amplitude of the pulse (the smoother line beginning and ending in the lower corners) and the optimum phase (the stepped line beginning and ending at the middle sides) that is required to apply multiphoton intrapulse interference such that SHG signal is optimized at 405nm and is suppressed elsewhere. The bottom panel shows the resulting experimental SHG output (dots) together with the multiphoton intrapulse interference theory/calculations (continuous line). The desired signal was achieved using multiphoton intrapulse interference, and notice the excellent agreement between experiment and theory.

VI. Notwithstanding, independent Claim 1 has been amended to add "binary phase values" and "automatically" before "control." Support for this amendment can be found in the originally filed application at Paragraph Nos. [0059], [0079], [0085] and [0132]. Neither of the cited references teach or suggest these claimed features.

The "living tissue" use of independent Claim 26 and the microscopy probes of independent Claim 47 are also not taught or suggested by either of the cited references. The "living tissue" and microscopy probe use are positive claim elements and the cited references, by contrast, merely pertain to communications.

The Silberberg patent and 2000 Weiner publication cannot be combined as proposed by the Examiner with regard to all of the claims since these references do not teach or suggest the combinations of claim elements, Weiner is not enabling and teaches away, and radical hindsight reengineering would be required. Accordingly, the Examiner has made both legal and factual errors in her rejection. Thus, it is respectfully requested that the instant rejection be withdrawn and all of the claims be allowed.

VII. The Examiner has rejected Claim 52 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Silberberg et al. (U.S. Patent No. 6,327,068) in view of Kappel et al. (U.S. Patent No. 5,704,700) and Miyai (U.S. Patent Publication No. 2001/0015990). This rejection is respectfully traversed. It is believed that the originally filed claims are patentably distinct over the cited references.

Radical hindsight reengineering would be required to combine the very different devices of Kappel and Miyai with Silberberg. Notwithstanding, this rejection is deemed moot in light of the amendment and arguments pertaining to its base independent Claim 47. Accordingly, it is respectfully requested that the instant rejection be withdrawn.

VIII. Finally, the presently rejected claims have achieved a "pioneering status" recognized in the industry. For example, paragraph [0034] of U.S. Patent Publication No. 2005/0015120 (Seibel et al.) states "[e]ffective three-photon suppression to avoid unwanted high-energy absorption has been demonstrated by phase-controlled multi-photon interference," citing to a 2003 Journal of Chemical Physics article written by the inventors of the present invention corresponding to many of the present claims. The following provides additional, objective evidence of non-inherency and secondary considerations of nonobviousness of the MII and MIIPS claims.

A. Third Party Laudatory Publications

Additional publications favorably citing the MII and MIIPS of various claims in the present application include:

1. S. Shimizu et al., "Spectral Phase Transfer for Indirect Phase Control of Sub-20-fs deep UV Pulses," Optics Express, Vol. 13, No. 17 (2005), page 6346 at n. 2;

2. S. Lim et al., 'Single-pulse phase-control Interferometric coherent anti-Stokes Raman Scattering Spectroscopy," Physical Review A 72 (2005), page 2 at n. 15;

3. J. Underwood et al., "Switched Wave Packets: A Route to Nonperturbative Quantum Control," Physical Review Letters, Vol. 90, No. 22, (June 6, 2003), page 1 at n. 8;

4. M. Renard et al., "Controlling Ground-State Rotational Dynamics of Molecules by Shaped Femtosecond Laser Pulses," Physical Review A 69 (2004), page 2 at n. 42;

5. A. Powe et al., "Molecular Fluorescence, Phosporescence, and Chemiluminescence Spectrometry," Anal. Chemistry, Vol. 76, No. 16, (August 15, 2004), page 4618 at n. D9, D10, D11;

6. W. Zipfel et al., "Nonlinear Magic: Multiphoton Microscopy in the Biosciences," Nature Biotechnology, Vol. 21, No. 11 (November 2003), page 1375 at n. 141;

7. B. Pearson et al., "Control of Raman Lasing in the Nonimpulsive Regime," Physical Review Letters, Vol. 92, No. 24 (2004), page 1 at n. 15, 16;

8. V. Prokhorenko et al., "Coherent Control of the Population Transfer in Complex Solvated Molecules at Weak Excitation. An Experimental Study," J. Chem. Phys. 122, 184502 (2005), page 1 at n. 16;

9. J. Olgilvie, et al., "Use of Coherent Control for Selective Two-Photon Fluorescence Microscopy in Live Organisms, "Optical Society of Am. at n. 1, 2, 7, 8, 9 (2006);

10. S. Lim, et al., "Chemical Imaging by Single Pulse Interferometric Coherent Anti-Stokes Raman Scattering Microscopy," J. Phys. Chem. B, Vol. 110, No. 11, 5196, 5199 right column (2006);

11. J. Kolenda, et al., "Pulse Shaping With the MIIPS-Process," Laser Technology, Photonik International – 2008/1, originally published in German in Photonik (March 2007), pages 68-70;

12. S. Butcher, et al., "Multiphoton Approach Shapes Ultrafast Pulses," Pulse Shaping, Institute of Physics and IOP Publishing Ltd. (2006);

13. D. Bender, et al., "Modified Spectrum Autointerferometric Correlation (MOSAIC) for Single-Shot Pulse Characterization," Optics Letters, Vol. 32, No. 19 (October 1, 2007), pages 2822-2824; and

14. B. von Vacano, et al., "Shaper-Assisted Collinear SPIDER: Fast and Simple Broadband Pulse Compression in Nonlinear Microscopy;" J. Opt. Soc. Am. B, Vol. 24, No. 5 (May 2007), pages 1091-1100.

15. H. Wong, et al., "Generation of 0.5 mJ, Few-Cycle Laser Pulses by an Adaptive Phase Modulator," Optics Express, Vol. 16, No. 19, page 14448 (15 September 2008); see pages 14452-14455. (see Exhibit B).

B. Awards for MII

An Innovation Award Certificate and the publication of same by *LaserFocusWorld* magazine (see Exhibit C) recognizes the licensee of the present application, Biophotonic Solutions, Inc. for "Unlocking the Power of Femtosecond Lasers Using MIIPS-For developing a pulse shaper that can automatically measure and compensate phase distortions that broaden femtosecond laser pulses." This proves that those skilled in the industry recognize the innovative merits, nonobviousness and noninherency of at least the claims specifically including MII or MIIPs.

In view of the instant amendments, it is submitted that the present application is in condition for allowance. Accordingly, it is requested that the Examiner pass the case to issue at her earliest convenience.

Respectfully submitted,

Dated: Sept. 16, 2008

By: ______________________
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